

What is claimed is:

1. A method for improving coding efficiency in audio coding, wherein an audio signal is encoded for providing parameters indicative of the audio signal, the parameters including pitch contour data containing a plurality of pitch values representative of an audio segment in time, said method comprising the steps of:

5 creating, based on the pitch contour data, a plurality of simplified pitch contour segment candidates, each candidate corresponding to a sub-segment of the audio signal;

measuring deviation between each of the simplified pitch contour segment

10 candidates and said pitch values in the corresponding sub-segment;

selecting one of said candidates based on the measured deviations and one or more pre-selected criteria; and

coding the pitch contour data in the sub-segment of the audio signal corresponding to the selected candidate with characteristics of the selected candidate.

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2. The method of claim 1, wherein the pitch contour data in the audio segment in time is approximated by a plurality of selected candidates, corresponding to a plurality of consecutive sub-segments in said audio segment, each of said plurality of selected candidates defined by a first end point and a second end point, and wherein said coding comprises the step of providing information indicative of the end points so as to allow the 20 decoder to reconstruct the audio signal in the audio segment based on the information instead of the pitch contour data.

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3. The method of claim 1, wherein the number of pitch values in some of the 25 consecutive sub-segment is equal to or greater than 3.

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4. The method of claim 1, wherein said creating is limited by a pre-selected condition such that the deviation between each of the simplified pitch contour segment candidates and each of said pitch values in the corresponding sub-segment is smaller than or equal to a pre-determined maximum value.

5. The method of claim 4, wherein the created segment candidates have various lengths, and said selecting is based on the lengths of the segment candidates, and the pre-selected criteria include that

the selected candidate has the maximum length among the segment candidates.

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6. The method of claim 4, wherein said selecting is based on the lengths of the segment candidates, and the pre-selected criteria include that

the measured deviation is minimum among a group of the candidates having the same length.

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7. The method of claim 1, wherein each of the simplified pitch contour segment candidates has a starting point and an end point, and said creating is carried out by adjusting the end point of the segment candidates.

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8. The method of claim 1, wherein the audio signal comprises a speech signal.

9. The method of claim 2, wherein at least one of the selected candidates is a linear segment.

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10. The method of claim 2, wherein at least one of the selected candidates is a non-linear segment.

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11. A coding device for encoding an audio signal comprising pitch contour data containing a plurality of pitch values representative of an audio segment in time, said coding device comprising:

an input end for receiving the pitch contour data; and  
a data processing module, responsive to the pitch contour data, for creating a plurality of simplified pitch contour segment candidates, each candidate corresponding to a sub-segment of the audio signal, wherein the processing module comprises:

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an algorithm for measuring deviation between each of the simplified pitch contour segment candidates and said pitch values in the corresponding sub-segment; and

an algorithm for selecting one of said candidates based on the measured deviations and pre-selected criteria.

12. The coding device of claim 11, further comprising  
5 a quantization module, responsive to the selected candidate, for coding the pitch contour data in the sub-segment of the audio signal corresponding to the selected candidate with characteristics of the selected candidate.

13. The coding device of claim 12, wherein the quantization module provides audio  
10 data indicative of the coded pitch contour data in the sub-segment, said coding device further comprising

a storage device, operatively connected to the quantization module to receive the audio data, for storing the audio data in a storage medium.

15 14. The coding device of claim 12, further comprising an output end, operatively connected to a storage medium, for providing the coded pitch contour data to the storage medium for storage.

15. The coding device of claim 12, further comprising an output end for transmitting  
20 the coded pitch contour data to the decoder so as to allow the decoder to reconstruct the audio signal also based on the coded pitch contour data.

16. A computer software product embodied in an electronically readable medium for  
use in conjunction with an audio coding device, the audio coding device providing  
25 parameters indicative of the audio signal, the parameters including pitch contour data containing a plurality of pitch values representative of an audio segment in time, said software product comprising:

30 a code for creating a plurality of simplified pitch contour segment candidates based on the pitch contour data, each candidate corresponding to a sub-segment of the audio signal;

a code for measuring deviation between each of the simplified pitch contour segment candidates and said pitch values in the corresponding sub-segment; and

a code for selecting one of said candidates based on the measured deviations and pre-selected criteria, so as to allow a quantization module to code the pitch contour data in the sub-segment of the audio signal corresponding to the selected candidate with characteristics of the selected candidate.

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17. A decoder for reconstructing an audio signal, wherein the audio signal is encoded for providing parameters indicative of the audio signal, the parameters including pitch contour data containing a plurality of pitch values representative of an audio segment in time, and wherein the pitch contour data in the audio segment in time is approximated by a plurality of consecutive sub-segments in the audio segment, each of said sub-segments defined by a first end point and a second end point, said decoder comprising:

an input for receiving audio data indicative of the end points defining the sub-segments; and

15 a reconstructing module, for reconstructing the audio segment based on the received audio data.

18. The decoder of claim 17, wherein the audio data is recorded on an electronic media, and wherein the input of the decoder is operatively connected to electronic media for receiving the audio data.

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19. The decoder of claim 17, wherein the audio data is transmitted through a communication channel, and wherein the input of the decoder is operatively connected to the communication channel for receiving the audio data.

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20. An electronic device comprising:

a decoder for reconstructing an audio signal, wherein the audio signal is encoded for providing parameters indicative of the audio signal, the parameters including pitch contour data containing a plurality of pitch values representative of an audio segment in time, and wherein the pitch contour data in the audio segment in time is approximated by a plurality of consecutive sub-segments in the audio segment, each of said sub-segments defined by a first end point and a second end point, so as to allow the audio segment to be constructed based on the end points defining the sub-segments; and

an input for receiving audio data indicative of the end points and for providing the audio data to the decoder.

21. The electronic device of claim 20, wherein the audio data is recorded in an  
5 electronic medium, and wherein said input is operatively connected to the electronic  
medium for receiving the audio data.

10 22. The electronic device of claim 20, wherein the audio data is transmitted through a  
communication channel, and wherein the input is operatively connected to the  
communication channel for receiving the audio data.

23. The electronic device of claim 20, comprising a mobile terminal.

24. A communication network, comprising:

15 a plurality of base stations; and  
a plurality of mobile stations communicating with the base stations, wherein at  
least one of the mobile stations comprises:

20 a decoder for reconstructing an audio signal, wherein the audio signal is  
encoded for providing parameters indicative of the audio signal, the parameters  
including pitch contour data containing a plurality of pitch values representative of  
an audio segment in time, and wherein the pitch contour data in the audio segment  
in time is approximated by a plurality of consecutive sub-segments in the audio  
segment, each of said sub-segments defined by a first end point and a second end  
point, so as to allow the audio segment to be constructed based on the end points  
defining the sub-segments; and

25 an input for receiving audio data indicative of the end points from at least  
one of the base stations for providing the audio data to the decoder.